

CLAIMS

1. A photonic crystal having a heterostructure, which is characterized in that it comprises:

5 a) a first forbidden band zone and a second forbidden band zone, located adjacent to each other;

b) a trunk waveguide obliquely crossing a boundary between the two forbidden band zones, which is designed so that a multiplexed/demultiplexed wavelength band constituting of a segment of a transmission wavelength band in the first forbidden band zone is excluded

10 from a transmission wavelength band in the second forbidden band zone; and

c) a branch waveguide extending from an intersection of the trunk waveguide and the aforementioned boundary into the first forbidden band zone and being designed so that its transmission wavelength band includes the aforementioned multiplexed/demultiplexed wavelength band.

15

2. The photonic crystal having a heterostructure according to claim 1, which is characterized in that it comprises two or more forbidden band zones aligned in series along the trunk waveguide, with the multiplexed/demultiplexed wavelength band of each forbidden band zone being included in the transmission wavelength band of the trunk waveguide in all 20 the forbidden band zones located on an upstream side, which is defined as a side where the branch waveguide extends from the intersection of the boundary of the forbidden band zones and the trunk waveguide.

3. The photonic crystal having a heterostructure according to claim 2, which is 25 characterized in that a blocking zone for blocking light within the transmission wavelength

band of the trunk waveguide of the forbidden band zone located at the most downstream position is connected to the aforementioned forbidden band zone, a boundary between the aforementioned forbidden band zone and the blocking zone is obliquely formed with respect to the trunk waveguide, and another branch waveguide is formed from an intersection of the 5 boundary and the trunk waveguide into the aforementioned forbidden band zone.

4. The photonic crystal having a heterostructure according to claim 1, which is characterized in that the forbidden band zone consists of a two-dimensional photonic crystal having a slab-shaped body in which areas whose refractive index differs from that of the 10 body are cyclically arranged.

5. The photonic crystal having a heterostructure according to claim 4, which is characterized in that the trunk waveguide is formed by creating a linear defect of the modified refractive index areas and a cycle of the modified refractive index areas is changed 15 from one forbidden band zone to another.

6. The photonic crystal having a heterostructure according to claim 4, which is characterized in that the trunk waveguide is formed by creating a linear defect of the modified refractive index areas and a shape or size of the modified refractive index areas is 20 changed from one forbidden band zone to another.

7. The photonic crystal having a heterostructure according to claim 4, which is characterized in that the modified refractive index areas is made of air.

25 8. The photonic crystal having a heterostructure according to claim 1, which is

characterized in that the branch waveguide is constructed so that it allows light to propagate within the multiplexed/demultiplexed wavelength band but prevents a propagation of light passing through the trunk waveguide within a predetermined wavelength band excluded from the multiplexed/demultiplexed wavelength band.

5

9. The photonic crystal having a heterostructure according to claim 8, which is characterized in that a width of the branch waveguide is determined so that the branch waveguide allows light to propagate within the multiplexed/demultiplexed wavelength band but prevents the propagation of light passing through the trunk waveguide within a 10 predetermined wavelength band excluded from the multiplexed/demultiplexed wavelength band.

10. The photonic crystal having a heterostructure according to claim 8, which is characterized in that the forbidden band zone consists of a two-dimensional photonic crystal 15 having a slab-shaped body, and a clad member is provided in contact with the branch waveguide.

20

11. The photonic crystal having a heterostructure according to claim 8, which is characterized in that a bend section is formed in the branch waveguide.

12. The photonic crystal having a heterostructure according to claim 11, which is characterized in that the forbidden band zone consists of a two-dimensional photonic crystal having a slab-shaped body provided with a cyclic arrangement of areas whose refractive index differs from that of the body, and a size and/or shape of the modified refractive index 25 area or areas in proximity to the bend section differs from that of the other modified

refractive index areas.

13. The photonic crystal having a heterostructure according to claim 8, which is characterized in that the forbidden band zone consists of a two-dimensional photonic crystal having a slab-shaped body provided with a cyclic arrangement of areas whose refractive index differs from that of the body, and a size and/or shape of modified refractive index area or areas in proximity to the connection point of the trunk waveguide and the branch waveguide differs from that of the other modified refractive index areas.

10 14. An optical multiplexer/demultiplexer, which is characterized in that it comprises a photonic crystal according to claim 1 and functions as an optical demultiplexer which uses the trunk waveguide as an input waveguide and the branch waveguide as an output waveguide, and also as an optical multiplexer which uses the branch waveguide as an input waveguide and the trunk waveguide as an output waveguide.

15

15. An optical transmitter/receiver, which is characterized in that it comprises a photonic crystal according to claim 1, an optical transmitter located in either the trunk waveguide in the second forbidden band zone or the branch waveguide, and an optical receiver provided in the other of the aforementioned two waveguides.